

1           1. An apparatus for providing a variable flow of liquid [A controller for  
2       varying the flow rate of a pump in a predetermined manner], comprising:

3  
4           a. a controller for varying the flow rate of an AC permanent magnet  
5       synchronous motor pump in accordance with AC pulse switching signals applied  
6       to said motor pump;

7  
8           b[a]. a programmable micro-controller incorporated into said controller,  
9       comprising means [for] calculating in a related manner both the pulse width and  
10      frequency [timing for generating] of said AC pulse switching signals [to] for  
11      synchronously controlling said motor pump over an extended range of flow rates;  
12      and

13  
14          c[b]. an output switching circuit incorporated into said controller,  
15      comprising means [for] generating an AC pulse [d] waveform for driving said  
16      motor pump according to said AC pulse switching signals.

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18  
19          2. The apparatus [The pump] of Claim 1 further comprising an AC  
20      permanent-magnet synchronous motor pump [and a rotor and impeller assembly  
21      coupled to said motor] for providing an output flow of liquid.

22  
23          3. [The rotor and impeller assembly] The apparatus of Claim 2, further  
24      comprising a rotor and impeller assembly integrally coupled to said motor pump,  
25      wherein said [rotor and impeller] assembly is comprised of a rotor and an  
26      impeller, [and] wherein said rotor and said impeller are concentric and wherein  
27      said assembly has means defining a rigid coupling between said rotor and said  
28      impeller for preventing relative rotation of said impeller with respect to said rotor.

1           4. The [controller] apparatus of Claim 1, further comprising a mode switch  
2 for choosing the mode of operation of said micro-controller, wherein the mode of  
3 operation is selected from a group comprised of a programmed flow control  
4 variation mode, an audio input mode, a manual mode and an external data  
5 input/output mode.

6  
7           7. The [controller] apparatus of Claim 1 further comprising:

8  
9           a. audio circuitry [for causing] with means varying the flow rate of an AC  
10 permanent magnet synchronous motor pump [of said motor pump to vary]  
11 [proportionately] in proportion to a signal from a microphone or an external audio  
12 input, wherein said circuitry further comprises an amplifier with a first  
13 potentiometer for varying said amplifier's gain and a detector circuit for providing  
14 a varying DC level to an analog to digital converter for input into said micro-  
15 controller; and

16  
17           b. a second potentiometer coupled to said analog to digital converter for  
18 adjustment of operational parameters dependent on the switch position of said  
19 mode switch.

20  
21           8. The [controller] apparatus of Claim 1, further comprising a line  
22 receiver/transmitter for interfacing an external data input/output signal to said  
23 micro-controller.

24  
25           9. The [controller] apparatus of Claim 1, further comprising rectifier  
26 circuitry for converting alternating current to direct current for driving said micro-  
27 controller [, said analog to digital converter, said audio circuitry] and said  
28 switching circuit[ry].

1           10. The [controller] apparatus of Claim 1, further comprising a [n  
2 embedded] software program embedded in said micro-controller for controlling  
3 the behavior of said motor pump over time [dependent upon the settings of said  
4 mode switch, said first potentiometer and said second potentiometer].

5  
6           12. The apparatus of Claim 2 further comprising [A] a fountain directly  
7 coupled to said AC permanent magnet synchronous motor pump for generating  
8 variable water patterns comprising:

9  
10           a. at least one fountain element comprised of a water inlet and one or  
11 more water outlets for the flow of water [;].

12  
13           [b. an AC permanent-magnet synchronous motor pump having a rigidly  
14 coupled rotor and impeller, the output of said pump connected to the inlet of said  
15 fountain element;]

1 1. (amended) An apparatus for providing a variable flow of liquid,  
2 comprising:

3  
4 a. a controller for varying the flow rate of an AC permanent magnet  
5 synchronous motor pump in accordance with AC pulse switching signals applied  
6 to said motor pump;

7  
8 b. a programmable micro-controller incorporated into said controller,  
9 comprising means calculating in a related manner both the pulse width and  
10 frequency of said AC pulse switching signals for synchronously controlling said  
11 motor pump over an extended range of flow rates; and

12  
13 c. an output switching circuit incorporated into said controller, comprising  
14 means generating an AC pulse waveform for driving said motor pump according  
15 to said AC pulse switching signals.

16  
17 2. (amended) The apparatus of Claim 1 further comprising an AC  
18 permanent-magnet synchronous motor pump for providing an output flow of  
19 liquid.

20  
21 3 (amended). The apparatus of Claim 2, further comprising a rotor and  
22 impeller assembly integrally coupled to said motor pump, wherein said assembly  
23 is comprised of a rotor and an impeller, wherein said rotor and said impeller are  
24 concentric and wherein said assembly has means defining a rigid coupling  
25 between said rotor and said impeller for preventing relative rotation of said  
26 impeller with respect to said rotor.

1 4. (amended) The apparatus of Claim 1, further comprising a mode switch  
2 for choosing the mode of operation of said micro-controller, wherein the mode of  
3 operation is selected from a group comprised of a programmed flow control  
4 variation mode, an audio input mode, a manual mode and an external data  
5 input/output mode.

6  
7 7. (amended) The apparatus of Claim 1 further comprising:

8  
9 a. audio circuitry with means varying the flow rate of an AC permanent  
10 magnet synchronous motor pump in proportion to a signal from a microphone or  
11 an external audio input, wherein said circuitry further comprises an amplifier with  
12 a first potentiometer for varying said amplifier's gain and a detector circuit for  
13 providing a varying DC level to an analog to digital converter for input into said  
14 micro-controller; and

15  
16 b. a second potentiometer coupled to said analog to digital converter for  
17 adjustment of operational parameters dependent on the switch position of said  
18 mode switch.

19  
20 8. (amended) The apparatus of Claim 1, further comprising a line  
21 receiver/transmitter for interfacing an external data input/output signal to said  
22 micro-controller.

23  
24 9. (amended) The apparatus of Claim 1, further comprising rectifier  
25 circuitry for converting alternating current to direct current for driving said micro-  
26 controller and said switching circuit.

1 10 (amended) The apparatus of Claim 1, further comprising a software  
2 program embedded in said micro-controller for controlling the behavior of said  
3 motor pump.

4  
5 12. (amended) The apparatus of Claim 2 further comprising a fountain  
6 directly coupled to said AC permanent magnet synchronous motor pump for  
7 generating variable water patterns comprising:

8  
9 a. at least one fountain element comprised of a water inlet and one or  
10 more water outlets for the flow of water.

11  
12 13. The audio circuitry and analog to digital converter of Claim 7, further  
13 comprising rectifier circuitry for converting alternating current to direct current for  
14 driving said audio circuitry and said analog to digital converter.

15  
16 14. An apparatus for providing a variable flow of liquid, comprising:

17  
18 a. a controller for varying the flow rate of an AC permanent magnet  
19 synchronous motor pump in accordance with the simultaneous variation of the  
20 voltage and frequency of the AC signal applied to said motor pump;

21  
22 b. a programmable micro-controller incorporated into said controller,  
23 comprising means calculating in a related manner both the voltage and  
24 frequency of said AC signal for synchronously driving said motor pump over an  
25 extended range of flow rates; and

26  
27 c. an output circuit incorporated into said controller comprising means  
28 generating said AC signal for driving said motor pump.

- 1 15. An apparatus for providing a variable flow of liquid, comprising a  
2 controller with means simultaneously varying in a related manner the voltage and  
3 frequency of an AC signal applied to said motor pump for extending the  
4 attainable range of pump flow rates.
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